SECTION 92

LIGHTING SYSTEMS

92.1 REFERENCES

(92A) Code of Federal Regulations – 46 CFR Sub-chapter J

(92B) NATIONAL ELECTRIC CODE (NEC)

(92C) IESNA RP-12-97 – *Recommended Practice for Marine Lighting*

92.2 INTRODUCTION

This Section covers the Contractor Design and Provide general requirements for "NORMAL" lighting, "EMERGENCY" lighting, floodlights, and navigational aids lighting equipment.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

92.3 GENERAL

Reference (92C) forms part of this Contract, and shall be used, along with Authoritative Agency requirements, in the design of all lighting systems on the Vessel unless specifically specified otherwise in specific Sections of the Technical Specification.

The Vessel shall be lighted throughout with fluorescent and incandescent fixtures in accordance with this Technical Specification.

The Contractor shall perform a light survey to ensure that lighting illumination levels throughout the Vessel that in agreement with Reference (92C) and **TABLE 92-1** in this Section of the Technical Specification. All lighting fixtures of the same type/function shall be supplied from one (1) manufacturer.

As an aid to establish sufficient lighting levels, the Contractor shall perform a fully documented and validated lighting survey using OptiWin, LuxVision, or equal, to verify that the lighting levels meet the lighting levels specified prior to the installation on the Vessel. WSF will work with the Contractor to establish reflectances, illumination plane, etc. to assist with the set-up of the program. Regardless of the predictions, if the lighting survey demonstrates that adequate lighting levels have not been achieved, supplemental lighting fixtures shall be added to rectify.

Fluorescent lighting shall be used in passageways, passenger seating areas, restrooms, crew quarters, casings, Vehicle Decks, hold machinery spaces, Engine Rooms and operational spaces. Incandescent lighting shall be used for floodlights and limited “EMERGENCY” lighting as described in this Technical Specification.

Provide a complete, functional, and operational lighting system, including all wiring, fixtures, switches, controllers, junction boxes, disconnects, hangers, and other items and devices as required.

All lighting systems shall comply with Reference (92A) and 46 CFR §111. All lighting fixtures shall be constructed to UL-1570 thru 1574, or UL-1598 & 1598A, or equal as recognized by Authoritative Agencies, and bear the UL Marine label.

The only exception to the above UL standards requirement shall be the lighting fixtures installed in the paint lockers. These fixtures shall have explosion proof ratings and be in compliance with U.S. Coast Guard Regulations and the National Electric Code (NEC) requirements. Explosion proof fixtures shall be penetrated and sealed as required by 46 CFR §111 and UL 844.

Cables which penetrate weathertight, watertight, or drip-proof fixtures shall be provided with cable/cord grips (gland) of similar rating.

Lighting systems are classified as "NORMAL" if they are fed from the Ship's Service Switchboard and "FINAL EMERGENCY" if they are fed from the Emergency Switchboard. "EMERGENCY" lighting that may require continuity of operation shall be powered by individual back-up battery power supplies.

All fluorescent light fixture ballasts and back-plates shall be positively bonded (grounded) to the Vessel's structure. All incandescent lighting fixtures shall be bonded (grounded) to the Vessel's structure. In order to assure that all fixtures are thoroughly bonded to the Vessel's structure, and also for ease of installation by the Contractor, 3-conductor cabling shall be used. The hot and neutral conductors shall be wired in accordance with regulatory requirements. The third conductor shall carry the grounding of each fixture back to the grounding terminal strip in the distribution panel.

Except for three-way or four-way switches, in all cases where switches are required in lighting circuits, the switches shall be of the double-pole type connected to switch both the line and neutral sides of the circuit. This does not apply to lighting circuits switch using the PowerLink® system. When a lighting circuit is required to have a switch, the switch shall be a double pole type and be "T" rated.

Lighting in the Engineering spaces, Vehicle Decks, and Passenger spaces shall be switched at the lighting distribution panel and load centers serving the area using the PowerLink® system. Lighting in the Crew's quarters, Pilothouses, offices, casing and small spaces, and lockers shall have local switches located at the entrances to the space being served. Light switches in spaces with joiner bulkheads shall use ARROW HART, or equal, illuminated, two-pole switches that mount in the door jamb (see Section 4 of the Technical Specification).

Provide each "Normal" and "EMERGENCY" lighting fixture with an engraved laminated phenolic label. See the *Electrical Systems* Subsection in Section 24 of the Technical Specification for additional requirements, for installation and construction.

Lighting shall be zoned, but the Contractor shall arrange the feeds to the individual circuits to minimize the voltage drop to the most distant fixtures. After the Voltage Drop

Calculations are prepared, the Contractor shall update the Lighting Deck Plan(s) to show the actual configuration of the lighting and modify the cable numbering accordingly. The Contractor, taking into account fault current and voltage drop considerations, shall select the best point to feed each lighting circuit. This circuit arrangement shall require that the actual cable routing be shown on the lighting deck plans, and accuracy shall be maintained as to the circuit configuration. The As-Built drawings shall accurately identify each piece of cable in the system as described in Section 87 of the Technical Specification.

The first cable in each lighting circuit, (i.e., the cable from the panel circuit breaker to the first fixture), shall be a minimum of LSTSGU-9, or equivalent IEEE Std 1580-2001 cable, in size.

The Contractor shall install WIELAND Model GST 18/3, or equal, in-line plug and receptacle assemblies meeting the IEC IP 20 standard for the cables in and out of each two (2) foot and four (4) foot fluorescent fixture in all spaces not exposed to weather. The intent is to be able to remove any of these fixtures by unplugging the cables, removing the fixture mounting bolts, and removing the fixture to the workbench for repair and overhaul. In this way, a spare fixture can be easily put in place, thus minimizing disruptions to Crew and Passengers. Install WIELAND Model GST 18/3, or equal, in-line plugs meeting the IEC IP 55 standard where vapor-tight plugs are required, such as in the Engine Rooms.

Lighting fixtures shall not be used as junction or connection boxes. No more than two (2) individual cables shall be allowed to enter any single lighting fixture. At points in the lighting installation where the circuits split or branch, a junction box shall be installed. In situations where a light switch is installed and more than two (2) cables are required to accomplish the circuit, a separate junction box shall be installed. In situations where a string of lighting is installed and power daisy-chained from one (1) fixture to the next with only two (2) cables entering an individual fixture, no junction box is required. The maximum number of three (3) conductor cables allowed in a 4 inch × 4 inch junction box shall be four (4). Junction boxes used in the overhead of the Passenger Deck, Crew's quarters and other dry locations above the Passenger Deck need not be weather-tight, but all lighting junction boxes located in engineering spaces on the weather decks, or in wet or damp locations shall be watertight NEMA 4X. Junction boxes in the Paint Locker shall be explosion proof, if required.

All junction boxes used in temporary or "FINAL EMERGENCY" lighting circuits shall be watertight. All junction boxes shall be electrically bonded to the Vessel's structure. For additional requirements, see Section 87 of the Technical Specification.

Cables entering the top or sides of lighting fixtures shall be fitted with drip-proof or watertight, as required, cable/cord grips. All unused cable entry holes in lighting fixtures

shall be plugged with drip-proof plugs. Sealing with silicone **shall not** satisfy this requirement.

92.4 POWERLINK® LIGHTING AND SELECTED LOADS REMOTE CONTROL SYSTEM

For WSF Fleet-wide Standardization purposes provide SQUARE D PowerLink®-G3 remotely controlled lighting and distribution power panel boards as shown on the One Line Diagram. The panels are intended to remotely control lighting circuit breakers grouped in zones as well as individually from the EOS, and also from each Pilothouse.

92.4.1 Overview

SQUARE D PowerLink®-G3 NF2000G3 Programmable Controllers with embedded Ethernet connectivity shall be used to remotely operate circuit breakers controlling lighting loads individually, or grouped into lighting zones. Switches and pushbuttons shall generally be utilized as inputs to the PowerLink® Master Controller, and programming software used to map the output commands to the corresponding circuit breakers for control of both individual and grouped zone lighting. Although there are presently no plans to control lighting loads from PC Workstations or Touch Screen Flat Panels, software shall be installed in the HCS Workstations (one (1) in each Pilothouse and one (1) in the EOS) sharing a common fiber optic Ethernet with all PowerLink® Masters, that allows for this capability for the future. Additionally, the Controllers shall also be used to secure selected loads such as the EOS Remote Fuel Shut Offs and the Fire Door Release circuits. The Master controllers shall include a front panel LCD user interface (and power supply) for configuration, and an Ethernet connection port to provide true peer-to-peer (P2P) connectivity via a fiber optic Ethernet control network. The PowerLink® Master Controllers shall connect to OSMs (Optical Switch Modules) with copper conductors. The OSMs will connect all the PowerLink® Master Controllers via a fiber optic Ethernet Ring Topology. OSMs shall be capable of detecting a failure of one section of fiber, and automatic reconfiguration of routing addresses to provide redundancy at the Ethernet network level. The fiber optic Ethernet ring shall also be shared with four additional nodes consisting of (3) HVAC Control System (HCS) HMI Workstations and a HCS Network Automation Engine (NAE) or Network Automation Interface (NAI) to an N2 network (or latest version of data communications network as recommended by the HCS vendor). The fiber optic strands shall be separate dedicated fiber strands that form part of the Super LAN network. To maximize the survivability of the ring topology, the fiber ring shall have the legs separated to the maximum extent, longitudinally and transversely on the Vessel.

The lighting, or selected loads control system shall:

A. Control up to 168 remotely operable circuit breakers.

B. Assign any circuit breaker to any lighting zone, or selected load.

C. Provide occupant warning blink notification for each circuit breaker controlling a lighting circuit, or selected load.

D. Provide default schedules and actions for fail-safe mode.

E. Allow the HCS to control and monitor the following lighting, or selected load controller functions:

1. Controller status
2. Time/Date
3. Bus Status
4. Circuit breaker status
5. Astronomical clock
6. Switch input to relay output mapping (local or global)
7. Switch input properties
8. Relay output properties
9. Time-scheduled events (timers)
10. Switch input status (real time)
11. Relay output status (real time)
12. Direct "ON/OFF" control of relay outputs (real time)

92.4.2 Execution

Lighting controls from the Pilothouses shall be through switches or pushbuttons, programmed as inputs to the PowerLink® Master Controller. Lighting to be controlled from the Pilothouse utilizing the PowerLink® Controls are identified in various Subsections in this Section of the Technical Specification. Location, groupings and type of switches and pushbuttons shall be as directed by the Construction Master.

Lighting controls from the EOS shall consist of three (3) lighted pushbuttons ("Normal" – "Tie Up" – "Fueling"), programmed as inputs to a PowerLink® Master Controller. The "Normal" scheme would energize all lighting circuit breakers for in-service operation. The "Tie Up" scheme shall de-energize all lighting circuit breakers above the hold level that would normally be secured manually during a night tie-up. The "Fueling" light scheme energizes additional circuit breakers where lighting is required for fueling the Vessel during the night tie-up.

The three (3) HCS Workstations (One (1) in each Pilothouse and one (1) in EOS) shall also be equipped with HVAC software that is capable of interfacing to PowerLink® Master Controllers over the fiber optic Ethernet. ***Although there is not currently any provisions for controlling lights through the HVAC HCS Workstations, this capability is required for possible additions of lighting schemes during future expansion of lighting profiles. The software selected for the HCS Workstations shall contain those features and capabilities as listed below.***

The HCS EOS Workstation shall include the capability for comprehensive lighting control, or a selected load software package specifically designed for the control of lighting and other selected loads, and seamlessly integrated into the HCS. The Pilothouse Workstations will share some of the functionality with the EOS Workstation. Point inputs and outputs from the lighting control system, or selected loads shall have "real-time" interoperability with HCS software features including: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data, and Trend Analysis. Each lighting circuit or selected load shall have the capability to be independently controlled and overridden by the HCS. All scheduling, monitoring and control of lighting circuits, or selected load whether through a time-of-day schedule, through an event based command or from a global energy management routine shall be capable of being executed through the HCS, or locally as programmed.

When connected to the fiber optic Ethernet network of multiple load controllers, the HCS shall be capable of providing all control and monitoring functions for all lighting, and selected load controllers connected on the network including all network management functions.

The graphical software programming shall be capable of utilizing color to communicate information related to lighting zone, or selected load status and scheduling. The graphical program shall enable operators to manage the lighting system, or selected load based on a daily operating profile. The user shall have the capability to navigate within the system to check on the conditions, schedules, etc. by using a "point-and-click" interface based upon deck plans and area graphics.

The lighting, or selected loads control network shall be organized in to a logical hierarchy of systems, zones, lights, and loads. In this logical organization, "lighting" or "selected loads" shall refer to actual lighting, or selected load circuits controlled. Lighting may be divided into zones. "Area" shall refer to the physical area within the Vessel such as individual decks that contain multiple lighting zones or other geographical boundaries. Animated deck plans/backgrounds shall show lighting zones, or selected loads throughout the Vessel in color which provides a visual real time display of lighting, or selected load status. The colors shall be updated dynamically as zone and load status changes. The deck plan graphic shall be able to change colors on a zone-by-zone, and load basis to reflect the actual status in each zone and load. Deck plans shall include the Navigation Bridge Deck, Sun Deck, Passenger Deck, Upper Vehicle Deck, Lower Vehicle Deck, and Hold.

The software shall be programmed to provide a separate color graphic for:

1. Each deck, zone, and load controlled
2. Each schedule
3. Each trend

Each lighting, or selected loads control panel shall report its communication status to the HCS which shall provide a system advisory upon communication failure and restoration. Any HCS-controlled lighting, or selected load circuits shall be assignable to any lighting zone group, or selected load without rewiring of any kind should the zone or load assignments change.

The lighting, or selected loads control panels shall provide manual override of any of the Vessel's zones, or loads from the local LCD. Zones or loads that are placed in manual override shall not execute serial commands or switch input requests.

92.4.3 Division of Responsibilities

92.4.3.1 Lighting Control System Vendor Responsibilities

The Contractor shall provide SQUARE D PowerLink®-G3 NF2000G3 Lighting Controller Panels with embedded Ethernet connectivity, with LCD. **FIGURE 92-1** is a matrix providing a representative picture illuminating the salient features of how the PowerLink® Controlson equipment interfaces together for WSF Fleet-wide Standardized system architecture for PowerLink® Controlson on the Ethernet Network. Copper connections (in lieu of fiber optic) from the PowerLink® Master Controller to the OSM (Optical Switch Modules), installation of Fiber optics between OSMs to form a Ring Topology, and the installation of all nodes on the fiber optic Ethernet shall be provided by the Contractor.

The PowerLink® vendor shall provide the software and programming to map all lighting and load points to their interface module such that the appropriate switch and pushbutton inputs activate the correct circuit breaker outputs for both individual and combination lighting loads. Although it is not anticipated that the HCS Workstations as set forth in Section 12 of the Technical Specification will control lighting loads, for future expansion the HCS contractor shall be capable of reading these points via the generic vendor communication tables. The exchanged information includes all lighting system, or selected loads input and output points. The Contractor shall coordinate with the PowerLink® vendor and HCS vendor for specific requirements.

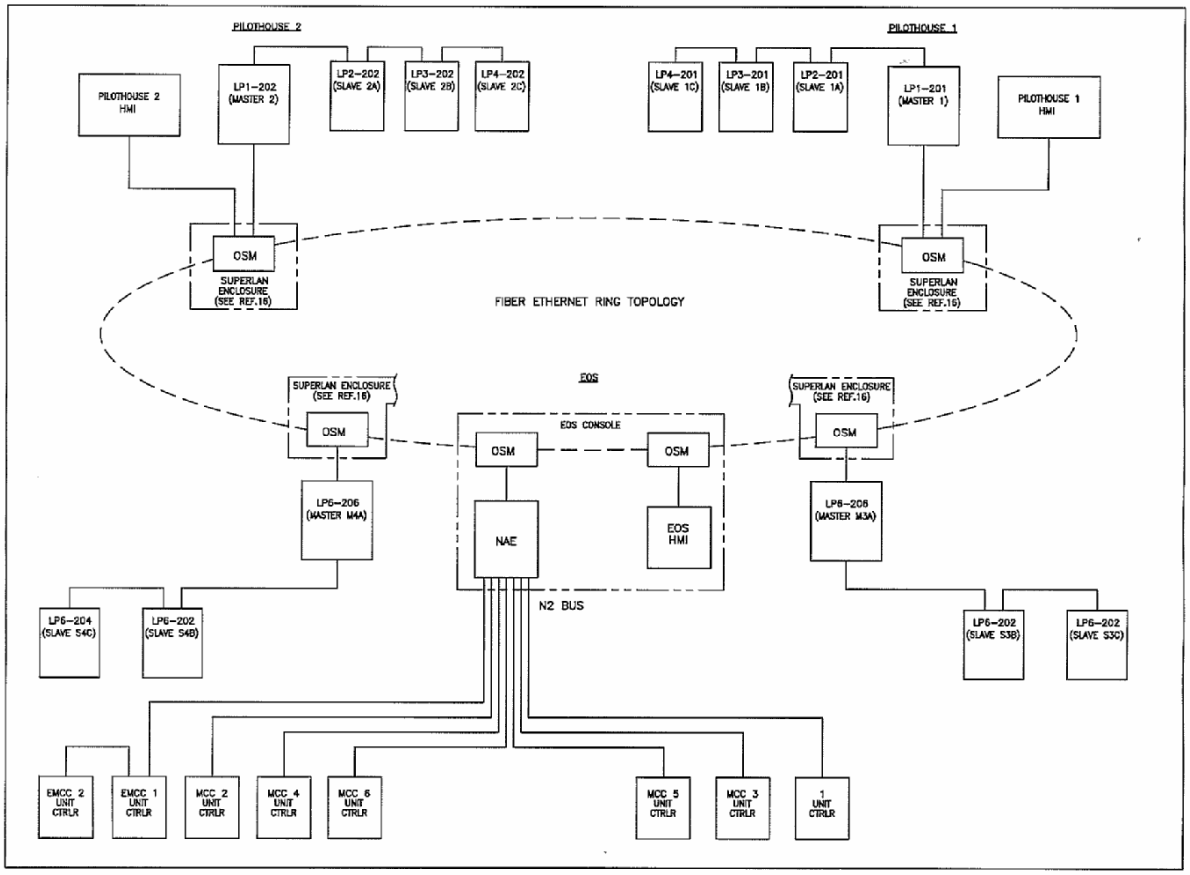

FIGURE 92-1
PowerLink® Controls on the Fiber Ethernet Network

The lighting, or selected load controllers data base including input object status, bus status, zone object control, input object control, time schedule, and sequence of operation configuration shall be programmed and downloaded using the PCS-101 software module (or latest version) by the PowerLink® vendor. The HCS vendor shall coordinate with WSF for direction in quantity, type and schedules for lighting zones, or selected loads.

Provide all software and custom field programming, including the PCS-101 programming software (or latest version), of the lighting, and selected load control system. The Contractor shall provide commissioning, WSF personnel training and warranty and shall verify that all devices are properly wired and operating. See the *TRAINING OF WSF PERSONNEL* Subsection in Section 1 of the Technical Specification for additional training requirements.

92.4.3.2 HCS Vendor Responsibilities

Coordinate with the PowerLink® vendor to provide correct HCS Workstation interfaces, and NAE or NAI Controller to interface the Ethernet to the HCS N2 network (or the most recent HCS recommended data communications network), for connection to the OSMs and the fiber optic Ethernet Ring.

Provide software that is capable of interfacing to the PowerLink® Lighting Controls through communications over the Ethernet for the future expansion of controlling additional lighting loads through the HCS Workstations. After the lighting, or selected loads control system has been completely programmed and commissioned by the PowerLink® system vendor, the HCS vendor shall connect to the Ethernet interface module.

If the HCS Workstation is utilized to control any lighting schemes, all data supported by the PowerLink® lighting, or selected loads control system shall be mapped into the supervisory HCS controller's database and shall be displayed on a dedicated lighting, or selected loads control system management graphical screen at the HCS Operator Workstation in the EOS. Additional Workstations shall be provided in Pilothouses No. 1 and No. 2.

Point inputs and outputs from the lighting, or selected loads control system shall have "real-time" interoperability with HCS software features such as: Control Software, Custom Process Programming, Alarm Management, Historical Data, and Reports Local Area Network Communications.

The system operator shall have the ability to monitor, command and override input/output points and data between the lighting, or selected loads control system and the HCS.

92.4.4 Sample Sequence of Operations

92.4.4.1 Pilothouse No. 1 and No. 2

NOTE: The intent of the SQUARE D PowerLink® panels in each Pilothouse is to allow, as on other WSF Vessels, the Vessel Master to turn off certain lighting on the current forward End of the Sun Deck, Passenger Deck, and Vehicle Decks, at either End of the Vessel, to protect the operator's night vision. As part of the base Work, the Contractor shall confer with the WSF Representative during the detailed design effort to determine those groups of lights which will

need to be turned off to protect Crew night vision. These groupings shall be reflected in the Contractor's design.

Switches and pushbuttons in each Pilothouse shall be arranged and grouped logically (as determined by the WSF Representative (Construction Master)) to control the following:

1. Control lighting circuits that interfere with night vision, either individually or by grouped control. Typically this shall cover the Sun Deck Passenger Lounges lighting and weather deck lighting (including Holiday lighting outlets as designated by the WSF Representative) on the Sun Deck and Navigational Bridge Deck, Passenger Cabin lighting and Picklefork lighting on the Passenger Deck and Vehicle Deck lighting on the forward Ends (both End No.1 and No. 2) of the Vessel.

2. Control landing lights.

3. Control evacuation lights.

4. Control Rescue Boat Davit lights

5. Closing of Fire Screen Doors by Zones.

6. Closing of Fire Dampers by Zones: The status of individual and zones of Fire Dampers shall be displayed on the HCS as described in Section 12 of the Technical Specification.

An example of circuit operation for operating the Evacuation Lights on the Number 2 End of the Vessel with a pushbutton located in Pilothouse No. 1 would be as follows:

1. Operator in Pilothouse No. 1 depresses the pushbutton for Evacuation Lights No. 2 End station.

2. Signal from the pushbutton is routed to a PowerLink® Master input.

3. Since the circuit breaker that controls the Evacuation Lights would probably be located in a slave panel on the other End of the Vessel, and controlled by a different PowerLink® Master than the one receiving the input command, the signal would be sent from the

PowerLink® Master located on End No. 1 to the PowerLink® Master located on End 2 over the fiber optic Ethernet.

4. The PowerLink® Master on End No. 2 would send a signal to a Slave panel over the PowerLink® Subnet to open or close the circuit breaker supplying power to the Evacuation Lights.

5. Feedback wired into the PowerLink® Master would energize or de-energize a pilot light at the pushbutton station panel to indicate lighting status.

92.4.4.2 Engineer's Operating Station (EOS)

A series of three (3) pushbuttons and pilot lights located on the EOS console shall be arranged to do the following:

1. Secure lighting in the Passenger Cabin and selected weather deck locations during night tie-up to minimize "light pollution" and Shore Power load requirements. Minimal path lighting shall be maintained to facilitate movement around the Vessel by the Crew, and Authoritative Agency requirements.

2. Secure lighting on the Vehicle Deck after night operations (fueling, taking on stores and spares) have been completed. Minimal path lighting shall be maintained to facilitate movement around the Vessel by the Crew, and Authoritative Agency requirements.

3. Adjust the normal lighting in three (3) ways using lighted pushbuttons on the EOS Control Console. The first button energizes all normal lighting circuit breakers above the hold level for in-service operation. The second button de-energizes all lighting circuit breakers above the hold level that would be secured for night tie-up. The third push button energizes only those lighting circuit breakers necessary for Vehicle Deck fueling operations while on night tie-up.

A typical example of the sequence of operation in going from "Normal" Ships lighting to "Tie-Up" lighting would be as follows:

1. After completing the running schedule for the day, the Operator in the EOS depresses the "Tie-Up" lighting pushbutton on the Control Console.

2. The pushbutton activation is input to the closest PowerLink® Master.

3. Commands are sent from the PowerLink® Master receiving the input command to all other PowerLink® Masters on the fiber optic Ethernet. The outputs that are programmed to be activated, both connected to the local PowerLink® Master and to a remote PowerLink® Master, open or close the appropriate circuit breakers in both the Master and Slave panels.

4. Feedback wired into the PowerLink® Master would energize or de-energize a pilot light at the pushbutton station panel to indicate status.

The HCS Vendor shall work with WSF to design the number, layout and presentation of the pages to be displayed on the Operator's Workstations.

See Sections 87 and 90 of the Technical Specification for descriptions of the required lighting panels and circuit breakers.

TABLE 92-1

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	**FC**	**Category[1]**	**Nominal Reflectance[2]**	**Speed and Accuracy[3]**	**Level or Deck**
EDG Radiator Area (Fidley)	50	5	C	M	I	Nav. Bridge
Pilothouse	200 0[6]	20 0	C -	M M	C C	Nav. Bridge
Master's Stateroom	300[7]	10	C	L	I	Nav. Bridge
Master's Stateroom Restroom	200	20	C	M	I	Nav. Bridge
Electrical Distribution Room	200	20	C	M	I	Nav. Bridge
Security Office	200	20	D	M	NI	Nav. Bridge
Unassigned Room	200	20	D	M	NI	Nav. Bridge
Ship's Office	200[5][7]	20	D	M	NI	Nav. Bridge
Ship's Office Restroom	200	20	C	M	I	Nav. Bridge
Crew Stair Tower	150	15	C	M	I	Nav. Bridge

TABLE 92-1, cont'd

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	FC	Category[1]	Nominal Reflectance[2]	Speed and Accuracy[3]	Level or Deck
Passenger Lounge	100	20	C	M	I	Sun
Unisex Restroom	200	20	C	M	I	Sun
Electrical Distribution Room	200	20	C	M	I	Sun
Linen Locker	50	5	C	M	NI	Sun
Cleaning Gear Locker	150	15	C	M	I	Sun
Deck Locker	150	15	C	M	I	Sun
Crew Stateroom	300[7]	10	C	L	NI	Sun
Dayroom	300[7]	20	C	M	NI	Sun
Crew Restroom	200	20	C	M	I	Sun
Crew Shower	200	20	C	M	I	Sun
Crew Passageway	150	15	C	M	I	Sun
Emergency Diesel Generator Room	300[4]	30	D	M	I	Sun
Fan Room	200	15	C	M	I	Sun
Crew Stair Tower	150	15	C	M	I	Sun

TABLE 92-1, cont'd

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	FC	Category[1]	Nominal Reflectance[2]	Speed and Accuracy[3]	Level or Deck
Elevator Shaft	50	5	B	M	I	Sun
Passenger Cabin	300	30	D	H	NI	Pass.
MES Station	300	30	D	H	NI	Pass.
Men's Restroom	200	20	C	M	I	Pass.
Women's Restroom	200	20	C	M	I	Pass.
Unisex Restroom	200	20	C	M	I	Pass.
Cleaning Gear Locker	150	15	C	M	I	Pass.
Electrical Distribution Room	200	20	C	M	I	Pass.
Passenger Stair Tower	200	20	C	M	I	Pass
Emergency Squad Locker	150	15	C	M	I	Pass.
Crew Dayroom	300[7]	20	D	M	NI	Pass.
Purser's Office	300[5][7]	20	D	M	NI	Pass.
Crew Stair Tower	150	15	C	M	I	Pass.

TABLE 92-1, cont'd

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	FC	Category[1]	Nominal Reflectance[2]	Speed and Accuracy[3]	Level or Deck
Vending Machine Area	300	30	D	H	NI	Pass.
Cafeteria	300	30	D	H	NI	Pass.
Elevator Shaft	50	5	B	M	I	Pass.
Upper Vehicle Decks	200	20	C	M	I	UVD
Passenger Stair Tower	200	20	C	M	I	UVD
Crew Stair Tower	150	15	C	M	I	UVD
Electrical Dist. Room	200	20	C	M	I	UVD
Deck Locker	150	15	C	M	I	UVD
Engineer's Paint Locker	150	15	C	M	I	UVD
Reserved Space	150	15	C	M	I	UVD
Cleaning Gear Locker	150	15	C	M	I	UVD
Elevator Shaft	50	5	B	M	I	UVD

TABLE 92-1, cont'd

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	FC	Category[1]	Nominal Reflectance[2]	Speed and Accuracy[3]	Level or Deck
Lower Vehicle Decks	200	20	C	M	I	LVD
Passenger Stair Tower	200	20	C	M	I	LVD
Engine Room Access	150	15	C	M	I	LVD
Fueling Equipment Locker	150	15	C	M	I	LVD
Crew Stair Tower	150	15	C	M	I	LVD
Stores Opening Area	300	30	D	M	I	LVD
Fueling Station	200	3	A	M	I	LVD
Parts Hatch Area	300	30	D	M	I	LVD
Gear Room Access	300	30	D	M	I	LVD
Crew Restroom	200	20	C	M	I	LVD
Deck Crew Shelter	300[7]	20	C	M	I	LVD
Tow Bridle Stowage	150	15	C	M	I	LVD
Gear Locker	150	15	C	M	I	LVD
Rescue Boat Station	150	15	C	M	I	LVD

TABLE 92-1, cont'd

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	FC	Category[1]	Nominal Reflectance[2]	Speed and Accuracy[3]	Level or Deck
Anchor Winch Area	150	10	C	C	H	LVD
Emergency Squad Locker	150	15	C	M	I	LVD
Engineer's Stores	150	15	C	M	I	LVD
Electrical Dist. Room	150	15	C	M	I	LVD
Line Stowage Locker	150	15	C	M	I	LVD
Elevator Shaft	50	5	B	M	I	LVD
Elevator Car	200	20	C	M	I	LVD
Steering Gear Room	300	30	D	M	I	Hold
Void	100	10	C	H	I	Hold
Tank Room	300	30	D	M	I	Hold
Reduction Gear Room	300	30	D	M	I	Hold
Engine Rooms	300[4]	30	D	M	I	Hold
SSDG No. 3 Acoustic Enclosure in Engine Room No. 2	300[4]	30	D	M	I	Hold

TABLE 92-1, cont'd

VESSEL ILLUMINANCE LEVELS

Space Description	Illuminance Selection Criteria					
	Lux	FC	Category[1]	Nominal Reflectance[2]	Speed and Accuracy[3]	Level or Deck
Engineer's Operating Station	300[4][7]	50	E	H	I	Hold
Chief Engineer's Office	300[5][7]	20	E	H	I	Hold
Engineer's Stores	200	5	B	M	I	Hold
Workshop	300[4][7]	30	D	M	I	Hold
Engineer's Dayroom	300[7]	75	E	M	I	Hold
Engineer's Restroom	200	20	C	M	I	Hold
Crew Locker Room/Stores	150	10	B	M	I	Hold

TABLE 92-1 Notes:

(1) Illuminance Categories are sets of illuminance ranges. Categories A through C are for general lighting; categories D through I are for illuminance on a task area.

(2) The Nominal Reflectance is the typical reflectance encountered for the listed task. Three ranges are used: High (H) greater than 70-percent(>70%); Medium (M) 30 through 70-percent (30%-70%); and Low (L) less than 30-percent (<30). A significant difference in the system being designed should be evaluated for adjustment of the weighting factor.

(3) The Speed and Accuracy represents how important is the correct performance of the task. Three values are specified: Not Important (NI); Important (I); and Critical (C).

(4) Supplementary lighting is recommended to provide design task illuminances.

(5) The recommended illuminances are for typical tasks and do not include special situations which may occur in practice. For detailed guidance see Reference (92C).

(6) At night the Pilothouse must be kept as dark as possible to permit visibility of objects on the water, hazards to navigation, and navigational lights.

(7) For crew endurance purposes, provide dual-circuit four-lamp, high intensity fluorescent fixtures such that a secondary 1000 lux illumination level is obtained by turning on a switchable ballast, which energizes the second lamp circuit. If necessary, use a dimmable ballast for light level control to adjust the lower light setting to 300 lux.

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

92.5 LIGHTING FIXTURES

Lighting fixtures shall meet all requirements of Underwriters Laboratories, Inc. (UL) and shall bear the UL "Marine" label appropriate for the area in which the fixture shall be installed. See 46 CFR §111 for detailed requirements. Lighting fixtures receiving Canadian CSA certification for compliance with UL standards shall be acceptable.

Unless stated otherwise in this Technical Specification, all lighting fixtures, both “NORMAL” and “EMERGENCY”, shall be fluorescent. Unless otherwise specified, fluorescent fixtures installed throughout the Vessel shall be provided with opal polycarbonate diffusers. Fluorescent fixtures shall be designed to accept 2-prong (bi-pin) fluorescent tubes unless otherwise specified in this Technical Specification.

Surface mounted fluorescent lighting fixtures installed on the Vehicle Decks, Steering Gear Rooms, stairwells that open to the weather, toilets and other damp or wet location shall have watertight one-piece Aluzink, or equal, coated bodies or **stainless steel** bodies. Surface mounted fluorescent area lighting fixtures not exposed to weather or not installed in wet or damp locations shall have watertight one-piece Epoxy Coated Aluzink, or equal, coated bodies or **steel** bodies. Fixtures shall be GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up), LIGHTPARTNER/MILS TL40-65 217 or 232 (-E with battery back-up), or LIGHTPARTNERS/MILS TL 44 250 with PLL base, 50-Watt Max T5, High output 4000 lumen, or equal, with internal reflector, clear polycarbonate cover with integral gasket, continuous clamping rails, and epoxy powder stove enamel finish with NEMA 4X rating. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

Fluorescent fixtures in the Passenger cabins shall be GLAMOX DLT 1002 (DLT 1006 with battery back up), or LIGHTPARTNER/MILS DE 95-65 232 (- E for battery back up) , or equal, designed for installation in 300mm DANACOUSTIC, or equal, ceilings as set forth in Section 25 of the Technical Specification, and fitted with opal polycarbonate lens covers. The lens shall be secured by spring clips and be capable of hinging from either side, or along one side only, for maintenance. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture. The body of the fixture shall be electro-galvanized steel with stove enamel “WHITE” epoxy finish.

Fluorescent lighting used in the passenger and working spaces shall be fluorescent rapid start type. All fixtures shall be designed to accept two (2) prong (medium bi-pin T-8) or plug-in four-prong T-5 high intensity fluorescent tubes as appropriate. In accommodation spaces the tubes shall be "Incandescent Fluorescent" color, and in other spaces the tubes shall be "COOL WHITE" color, except as noted elsewhere in this Technical Specification.

"EXIT" lighting fixtures shall be internally illuminated with battery back-up “HL 09” or “HL 15” by MARINE INDUSTRIAL LIGHTING SYSTEMS (MILS), or equal, and shall satisfy the requirements of 46 CFR§111 and 46 CFR§112. The exit fixtures shall have arrows on one or both sides, as is appropriate for the location, to indicate the nearest exit to the Vehicle Deck, embarkation areas, or weather decks.

Incandescent lighting fixtures normally fitted with standard Edison screw base bulbs shall be fitted with compact fluorescent lamps with screw bases. Lamps shall be PANASONIC brand, Model ELT-16, or equal. Illumination shall be equivalent to a 60-Watt incandescent bulb.

For WSF Fleet-wide Standardization purposes, all fluorescent fixtures provided shall be equipped with high power factor, MAGNETEK, Model No. B232I120RH ballast, or approved equal, except as noted elsewhere in this Section of the Technical Specification.

92.6 NAVIGATION BRIDGE DECK LIGHTING

92.6.1 General

Provide zoned lighting fixtures and receptacles throughout the Navigation Bridge Deck.

Provide compact fluorescent light fixtures adjacent to the top outside of all exterior doors on the Navigation Bridge Deck.

Provide "EXIT" lights as required by WSF and/or the USCG. See the *USCG Mandated Enhanced Fire Suppression Systems* Subsection in Section 13 of the Technical Specification for illuminated “EXIT” sign requirements.

Provide light fixtures for the Master’s Stateroom, Ship’s Office, Restrooms, Security Room, and Unassigned Room same type as set forth for Officer’s quarters and restrooms on the Sun Deck.

Provide light fixtures for the Electrical Distribution Rooms same type as set forth for Electrical Distribution Rooms on the Sun Deck.

92.6.2 Pilothouse Lighting

Provide “NORMAL” and “EMERGENCY” lighting in each Pilothouse.

Provide four (4) incandescent chart down lights in each Pilothouse (GUEST 811-2, LIGHTPARTNER/ MILS Ti 14, or equal) with “RED” filters centered on the chart table, on the Pilothouse Control Console, and the desk in each Pilothouse. Connect these lights directly to the DC “EMERGENCY” distribution panel. Provide 28 Vdc lamps (PHILLIPS 046677-36214-5, or equal) in these fixtures. Install these lamps so that they may be easily adjustable to chart locations. If necessary, provide a vertical support member onto the chart table to support this lamp.

Provide two (2) down lights equipped with 60-Watt incandescent parabolic lamps located above the Chart Desk in each Pilothouse. This circuit shall also be equipped with a dimmer. The dimmer shall be located on the starboard side of the Chart Desk.

Provide two (2) switched incandescent fixtures inside each Pilothouse Control Console.

All Pilothouse instrumentation lighting shall have variable intensity “RED” dial illumination fed from final “EMERGENCY” power circuits. The Contractor shall provide all dimmers not supplied by the Propulsion System Integration (PSI) Contractor, or other PSI Contractor subcontractors.

Provide Pilothouse “NORMAL” and “EMERGENCY” lighting, including switches located at each exterior door. All switching for overhead lighting and Pilothouse weather deck lighting (port & starboard) shall be controlled by 3-way circuits.

Provide flood and spotlight controls on each Pilothouse Control Console.

Provide searchlights and remote controls.

92.6.3 Fidley

Provide lighting fixtures, control switches, and all associated interconnecting cabling in the fidley on the Navigation Bridge Deck.

Provide “AMBER” compact florescent globe lighting fixtures at the entrance to the fidleys, Master’s Stateroom, Pilothouse doors, and Ship’s Office or any other exterior door on the Navigation Bridge Deck.

NOTE: The lighting in the temporary Emergency Diesel Generator radiator space shall be provided in accordance with U.S. Coast Guard and NEC requirements. A light switch and receptacle shall be installed within the Emergency Diesel Generator radiator space.

Lighting fixtures in the Emergency Diesel Generator radiator space within the fidley shall be GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up) or LIGHTPARTNER/MILS TL40-65 217 or 232 (-E with battery back-up), or equal, with Aluzink, or equal, coated bodies, with internal reflector, clear polycarbonate cover with integral gasket, continuous clamping rails, and epoxy powder stove enamel finish with NEMA 4X rating. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

92.7 SUN DECK LIGHTING

Provide zoned lighting fixtures and receptacles throughout the Sun Deck.

Provide compact fluorescent light fixtures adjacent to the top outside of all exterior doors on the Sun Deck.

Provide "EXIT" lights as required by USCG. See the *USCG Mandated Enhanced Fire Suppression Systems* Subsection in Section 13 of the Technical Specification for illuminated “EXIT” sign requirements.

92.7.1 Crew Quarters

Provide lighting fixtures, control switches, and all associated interconnecting cabling for all Crew spaces on the Sun Deck.

For Crew endurance purposes, provide dual-circuit four-lamp, high intensity fluorescent fixtures in the Crew Dayrooms and Staterooms such that a secondary 1000 Lux (92.9 footcandle) illumination level is obtained by turning on a switchable ballast, which energizes the second lamp circuit. If necessary, use a dimmable ballast for light level control to adjust the lower light setting on order to gain the 300 Lux normal lighting for the Crew space.

Provide two (2) fluorescent fixtures, GLAMOX DLT 1000 (DLT 1004 with battery back up) or LIGHTPARTNER/MILS DE 95-65 232 (- E for battery back up), or equal, fitted with opal polycarbonate covers in each Officer and Crew Stateroom. These fixtures are recess mounted in the 300 mm DANACOUSTIC, or equal, ceilings as set forth in Section 25 of the Technical Specification. The lens shall be secured by spring clips and be capable of hinging from either side, or from one (1) side only, for maintenance. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

Provide a minimum of six (6) fluorescent fixtures, GLAMOX DLT 1000 (DLT 1004 with battery back up) or LIGHTPARTNER/MILS DE 95-65 232 (- E for battery back up), or equal, fitted with opal polycarbonate covers in the Dayroom. These fixtures are recess mounted in the 300 mm DANACOUSTIC, or equal, ceilings as set forth in Section 25 of the Technical Specification. Each fixture shall have four (4) 50-Watt T5 High intensity lamps secured with locking 4-pin lamp holders and locking lamp cradle.

The Fixture shall be equipped with a switchable ballast that will allow the unit to operate on either two (2) lamps or four (4) lamps, or one (1) lamp or three (3) lamps to meet task illumination requirements.

The lens shall be secured by spring clips and be capable of hinging from either side, or along one (1) side only, for maintenance. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

Provide one (1) fluorescent fixture, GLAMOX DLT 1000 (DLT 1004 with battery back up) or LIGHTPARTNER/MILS DE 95-65 232 (- E for battery back up), or equal, fitted with opal polycarbonate covers in each Unisex Restroom, Officer and Crew Restroom, and Shower. These fixtures are recess mounted in the 300 mm DANACOUSTIC, or equal, ceilings as set forth in Section 25 of the Technical Specification. Each fixture shall have two (2) 17-Watt lamps. The lens shall be secured by spring clips and be capable of hinging from either side for maintenance. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

Provide AQUA SIGNAL Model 1194-227, or LIGHTPARTNER/MILS SP66 108, or equal, bunk lights in each Officer and Crew Stateroom, one (1) for each bunk.

Provide a 120 Vac fluorescent light fixture, PAULUHN F1061, or LIGHTPARTNER/MILS SP77 117, or equal, in each Unisex Restroom, Officer and Crew Stateroom, and Head above the mirror over the lavatory. Each fixture shall have one (1) 20-Watt lamp.

Provide a LIGHTPARTNER, or equal, desk light for all desks. Provide required cabling to connect power to the integral lights in the bulkhead mounted desks.

Provide a switch inside each Officer and Crew quarters on the non-hinged side of the door to control the overhead lights in each Crew quarters space.

92.7.2 Fidley

Provide lighting fixtures, control switches, and all associated interconnecting cabling in the fidley on the Sun Deck.

Lighting fixtures in the engineering spaces within the fidley shall be GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up), or LIGHTPARTNER/MILS TL44-250 or 450 (-E with battery back-up), or equal, with Aluzink, or equal, coated bodies, with internal reflector, clear polycarbonate cover with integral gasket, continuous clamping rails, and epoxy powder stove enamel finish with NEMA 4X rating. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture. Provide 3-way and 4-way switching circuits.

92.7.3 Emergency Diesel Generator Room

Provide lighting fixtures, control switches, and all associated interconnecting cabling in the Emergency Diesel Generator Room.

Lighting fixtures shall be GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up) or LIGHTPARTNER/MILS TL44-250 or 450 (-E with battery back-up), or equal, with Epoxy Coated Aluzink, or equal, bodies, with internal reflector, clear polycarbonate cover with integral gasket, continuous clamping rails, and epoxy powder stove enamel finish with NEMA 4X rating. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

92.7.4 Fan Rooms

Provide lighting fixtures, control switches, and all associated interconnecting cabling in the Fan Rooms.

Lighting fixtures shall be GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up), or LIGHTPARTNER/MILS TL44-250 or 450 (-E with battery back-up), or equal, with Aluzink, or equal, coated bodies, with internal reflector, clear polycarbonate cover with integral gasket, continuous clamping rails, and epoxy powder stove enamel finish with NEMA 4X rating. Electronics shall be mounted on a removable equipment tray with retainer straps to the fixture.

92.8 PASSENGER DECK LIGHTING

Provide "NORMAL" and "EMERGENCY" Passenger Deck lighting. All Passenger Deck lighting shall be fluorescent unless otherwise noted. Lighting on the Passenger Deck shall be installed in the 300mm DANACOUSTIC, or equal, ceiling as set forth in Section 25 of the Technical Specification, such that the lights are located to give maximum coverage over the installed seating.

All lighting in the MES Stations shall be on the "EMERGENCY" circuit.

For Crew endurance purposes, provide dual-circuit four (4) lamp, high intensity fluorescent fixtures in the Crew Dayroom and Purser's Office on the Passenger Deck such that a secondary 1000 Lux illumination level is obtained by turning on a switchable ballast, which energizes the second lamp circuit. If necessary, use a dimmable ballast for light level control to adjust the lower light setting to 300 Lux.

Provide GLAMOX Model DLT 1000 or 1002 (DLT 1004 or 1006 with battery back up) or LIGHTPARTNER/MILS DE 95-65 217 or 232 (- E for battery back up) fixtures, or equal, in areas with 300 mm DANACOUSTIC, or equal, ceilings as set forth in Section 25 of the Technical Specification, and GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up), or LIGHTPARTNER/MILS TL40-65 217 or 232 (- E for battery back up), or equal fixtures, in all other locations.

Provide AQUA SIGNAL 1196-128 2X20 fluorescent fixtures, or LIGHTPARTNER/MILS EL33 217, or equal, over each sink and vanity in the Women's Restroom and over each sink in the Men's and Unisex Restrooms. Center the fixtures over sinks and vanities leaving sufficient space between fixtures to remove end covers for tube replacement. Provide prismatic clear structure diffusers. Provide PHILIPS 3500KTL80, or equal, fluorescent tubes in all Women's Restroom fluorescent fixtures.

The two (2) groups of fluorescent lighting at the outboard end of each Passenger cabin shall be capable of control from the Pilothouse on their respective Ends. This is done to enable the Master to turn these lights off during low visibility or foggy conditions.

92.9 SMALL GALLEY AREA

In addition to the requirements of this Section of the Technical Specification, the Contractor shall provide in its design:

1. Light fixtures provided in the Small Galley area shall have diffusers with a smooth surface for ease of cleaning, and shall be fitted with deluxe color improving tubes.

2. Provide PROMOLUX, or equal, true full spectrum lamps which suits the design and enhances those products being displayed. Lamps shall have, at a minimum, a Color Rendering Index (CRI) of 78.

3. Food preparation and utensil washing areas shall be well lit. A light intensity of 100 footcandles (1,076 Lux) of light, measured thirty (30) inches above the deck is required.

4. Storage areas shall be provided with a minimum of 30 footcandles (3,228 Lux) of light, measured thirty (30) inches above the deck.

5. Protective shielding of light fixtures is required over all food preparation, display, service, storage, and utensil washing areas.

92.10 VEHICLE DECK LIGHTING

Provide “NORMAL” and “EMERGENCY” Vehicle Deck lighting.

92.10.1 Normal Lighting

All fixtures on each End of the Vessel shall be fed from “NORMAL” power and switched in their respective End Pilothouses.

Provide for the fixtures located on each End of the Vessel to be powered from separate circuits, controlled from the control console in the respective Pilothouse. This is done to enable the Master to turn these lights off during low visibility or foggy conditions.

Provide lighting in the Deck Crew Shelter space and all other spaces on the Upper and Lower Vehicle Decks. Provide the 1,000 Lux Crew endurance lighting in the Deck Crew Shelter same as outlined in the *SUN DECK LIGHTING* Subsection in this Section of the Technical Specification.

92.10.2 Emergency Lighting

Provide "EMERGENCY" lighting on the Vehicle Decks. Take care that the lighting located near the End of the Vessel is installed to give the maximum level of illumination on the Vehicle Deck while limiting the light reaching the Pilothouse. "EMERGENCY" lighting on the Vehicle Decks that could interfere with Pilothouse visibility shall be controlled by a switch in the Pilothouse on that End of the Vessel. This is done to enable the Master to turn these lights off during low visibility or foggy conditions. The determination of light interference with Pilothouse navigation shall be part of the required light survey as outlined in the *GENERAL* Subsection in this Section of the Technical Specification.

92.11 EOS AREA LIGHTING

Provide "NORMAL" and "EMERGENCY" lighting in the EOS area spaces.

For Crew endurance purposes, provide dual-circuit four-lamp, high intensity fluorescent fixtures in the EOS, Engineer's Dayroom, Workshop, and Chief Engineer's Office such that a secondary 1000 Lux illumination level is obtained by turning on a switchable ballast, which energizes the second lamp circuit. If necessary, use a dimmable ballast for light level control to adjust the lower light setting to 300 Lux.

Lighting fixtures in the engineering spaces within the EOS area spaces shall be GLAMOX GLIN 1014 or 1015 (GLIN 1045 or 1046 with battery back-up), or LIGHTPARTNER/MILS TL44-250 or 450 (-E with battery back-up), or equal, prismatic polycarbonate cover with integral gasket, full side rail lens clips, and "WHITE" baked on powder coated paint finish with NEMA 4X rating. Lamps shall be 50-Watt T5 secured with locking 4-pin lamp holders and locking lamp cradle. Electronics shall be mounted on a removable equipment tray that can be supported from the fixture for maintenance.

Provide 3-way and 4-way switching circuits. Provide task lighting at EOS Control Console, log desks, Switchboards, Chief Engineer's office desk, work benches, drill press, lathe, milling machine, and slop sink.

92.11.1 Normal Lighting

The Contractor shall take care that adjacent "NORMAL" lighting fixtures in the EOS area spaces are fed from different electrical phases to minimize the stroboscopic effect of fluorescent lighting. As an alternative, use high frequency electronic ballasts that reduce stroboscopic effects to acceptable levels.

92.11.2 Emergency Lighting

Provide battery back-up fluorescent lighting for EOS area spaces.

92.12 HOLD SPACE LIGHTING

Provide "NORMAL" and "EMERGENCY" Hold Space lighting.

Hold space lighting shall be suspended from the overhead by a minimum of two (2) 1½ inch diameter pipe brackets per fixture. On fixtures mounted on pipe foundations over twenty-seven (27) inches and less than forty (40) inches in length, a minimum of one (1) sway brace for the pipe foundations shall be included. On pipe foundations over forty (40) inches in length, a minimum of two (2) sway braces shall be provided. The sway brace shall consist of minimum ¾ inch diameter pipe and the attachment point on the sway brace shall be a minimum of at least half (½) the length of the pipe foundation. All lighting fixture foundations and sway braces shall be welded to deck beams or structure and **not** to deck plating. Fixture heights shall be selected to assure maximum lighting coverage, but be neither a personnel hazard nor be blocked by surrounding structure or machinery.

Several areas in the overhead of the Hold spaces have been designated Machinery Removal Access Areas. No permanent wiring or fixtures shall be installed on the underside of the Vehicle Decks in these areas. This includes wireways and cable runs. The only electrical equipment to be allowed within these areas shall be lighting fixtures subject to the following restrictions:

- Lighting fixtures located within the Machinery Removal Access Areas shall be located and mounted in such a manner so as to allow easy removal and temporary relocation without disconnecting the wiring.

- No wiring shall be run directly between lighting fixtures and junction boxes located within the areas.

- Wiring for lighting fixtures located within the areas shall be routed so that the light can be temporarily removed and pulled back out of the area without disconnecting the

wiring. If this is not practical, the fixtures may be wired through junction boxes located outside the areas.

92.12.1 Normal Lighting

The Contractor shall take care that adjacent "NORMAL" lighting fixtures in the engineering spaces are fed from different electrical phases to minimize the stroboscopic effect of fluorescent lighting. As an alternate, use high frequency electronic ballasts that reduce stroboscopic effects to acceptable levels.

Provide task lighting over gage panels, engine controls, work benches, and slop sinks.

92.12.2 Emergency Lighting

Provide fluorescent lighting throughout the hold spaces from the "FINAL EMERGENCY" power panels.

92.13 MISCELLANEOUS EXTERIOR LIGHTING

92.13.1 Exterior Deck Lighting

Provide exterior compact fluorescent deck lighting fixtures on the Sun Deck houses. Exterior lights on the Sun Deck and Navigation Bridge Deck shall have "AMBER" colored globes.

NOTE: For the purpose of this requirement, the lighting within the Sun Deck Passenger Lounges shall be "WHITE" lighting, same as the Passenger Deck and Vehicle Deck lighting (Not "AMBER").

The "NORMAL" power incandescent fixtures located immediately outside the Pilothouse exterior doors shall be provided with "AMBER" glass globes with shields. Lights shall be operable from inside the Pilothouses.

Provide four (4) PHOENIX PRODUCTS Model MRS 56/500 H floodlights, or equal, fitted with GE 300PAR56/MFL 300-Watt lamps, or equal, or LIGHTPARTNER/MILS ST76 300-Watt deep drawn stainless steel floodlights, or equal, to illuminate the Passenger Deck gangways. Mount the fixtures above the Passenger Pickleforks, on the Sun Deck railing, in such a manner as to illuminate the Picklefork areas during Passenger embarkation/debarkation. Provide "NORMAL" power from the power panels. The

floodlights shall be switched from the Pilothouse Control Consoles using the PowerLink® control system.

92.13.2 Landing Lights

Provide three (3) landing lights on each End of the Vessel. Switches shall be provided in each Pilothouse Control Console to control the landing lights on that End using the PowerLink® control system.

Mount one (1) PHOENIX PRODUCTS Model MRS 56/500 H floodlight, or equal, fitted with GE Q500PAR56/NSP 500-Watt lamp (narrow beam) or equal, or LIGHTPARTNER/MILS ST76 500-Watt deep drawn stainless steel floodlights, or equal, on centerline below the Pilothouse front and directed straight ahead of the Vessel. Provide a light shield over this fixture to minimize the amount of light entering the Pilothouse. Switching shall be as required above.

Mount two (2) PHOENIX PRODUCTS Model MRS 56/500 H floodlights, or equal, fitted with GE Q500PAR56/MFL 500-Watt lamps, or equal, or LIGHTPARTNER/MILS ST76 500-Watt deep drawn stainless steel floodlights, or equal, below the Passenger Deck wings. The electrical power source for these lights shall be "NORMAL" power. Switching shall be as required above.

92.13.3 Rescue Boat Davit Lights

See Section 16 of the Technical Specification for additional Rescue Boat requirements.

Provide two (2) PHOENIX PRODUCTS Model MRS 56/500 HS floodlights (quick release mount), or equal, fitted with GE 300PAR56/MFL 300-Watt lamps, or equal, or LIGHTPARTNER/MILS ST76 300-Watt deep drawn stainless steel floodlights, or equal. Mount one (1) each on the end of each Rescue Boat Davit arm. Ensure that the installed location permits the floodlights to illuminate the Rescue Boat throughout the entire launching operation and to illuminate the Rescue Boat boarding area.

The electric power source for these lights shall be Emergency Bus.

Both of the fixtures shall be controlled from either Pilothouse using the SQUARE D POWER LINK, or equal, system.

Provide "GREEN" power-on indicator lights at each switch location and locate the control switches and status indicator lights in the Pilothouse Control Console in each Pilothouse.

Provide a GLAMOX GLIN 1046 fixture, or LIGHTPARTNER/MILS TL40-65 232 (-E for battery back up), or equal, in the vicinity of the davit controls and power from the same circuit as the davit light.

92.13.4 High Slide Marine Evacuation Systems (MES) Floodlights

See Section 16 of the Technical Specification for additional High Slide MES Systems requirements.

Provide PHOENIX PRODUCTS Model MRS 56/500 HS floodlights (quick release mount), or equal, fitted with GE Q500PAR56/MFL 500-Watt lamps, or equal, or LIGHTPARTNER/MILS ST76 500-Watt deep drawn stainless steel floodlights, or equal, for illumination of High Slide Marine Evacuation Systems (MES) launching operations. WSF Drawing No. 8300W-505-92-1 (*latest revision*) represents a floodlight system amplifying the methodology acceptable to WSF. Mount the fixtures to illuminate the High Slide Marine Evacuation Systems (MES) through the entire launching operation. Wire the fixtures in pairs for each station and arranged so that **all** of the fixtures may be controlled from **either** Pilothouse by a single switch. This shall be accomplished using the SQUARE D PowerLink®, or equal, system.

The power source for the High Slide Marine Evacuation Systems (MES) fixtures shall be from the same End of the Vessel as its location and shall be fed from the Emergency Bus.

Provide “GREEN” power-on indicator lights at each switch location and locate the control switches and status indicator lights on each Pilothouse Control Console.

92.13.5 Path Lighting

Path lighting through the Passenger Cabin and Vehicle Decks shall be established so that during Tie Up periods, crew members can safely transit these spaces. Lighting circuits, normal and emergency, shall be laid out in consultation with WSF to achieve this objective. The WSF Representatives shall be consulted as to which lighting circuits shall be switched during the defined periods. This switching shall be accomplished using the SQUARE D PowerLink® system.

92.14 OTHER LIGHTING

Provide all other specialized lighting systems as described in this Section and as necessary to meet Authoritative Agencies requirements.

92.14.1 Elevator Lighting

Provide incandescent lighting in the elevator trunk overheads and in the elevator machinery spaces and pits.

Provide final "EMERGENCY" power to the lighting circuit on each elevator car. The "NORMAL" and "EMERGENCY" lighting fixtures located in the elevator cars must meet UL lighting standards.

Provide a Temporary "EMERGENCY" powered fluorescent fixture, GLAMOX GLIN 1045, or LIGHTPARTNER/MILS TL40-65 232 (- E for battery back up), or equal, at the top of the elevator trunks.

The receptacle, light, and Elevator inspectors switch mounted on top of each elevator car shall be watertight and meet L&I and U.S. Coast Guard requirements.

92.14.2 Engine Room Escape Ladder and Uptake Lighting

Provide "EMERGENCY" watertight fluorescent fixtures in the Engine Room escape inclined and vertical ladders and stairwells to illuminate the Engine Room escape ladders.

Provide non- "EMERGENCY" watertight fluorescent fixtures in the Uptakes at least every twenty (20) lineal feet vertically.

92.14.3 High Slide Marine Evacuation Systems (MES) Strobe Lights

See Section 16 of the Technical Specification for additional High Slide Marine Evacuation Systems (MES) requirements.

Provide an EDWARDS SIGNALING & SECURITY SYSTEMS, 105 Series, AdaptaBeacon Adverse Location Signal, NEMA 4X, "AMBER" flashing LED cluster strobe light (300,000 peak candlepower) system serving each MES Station. WSF Drawing No. 8300W-505-92-02M (*latest revision*) represents a strobe light system amplify the methodology acceptable to WSF. Mount each strobe light assembly high on the Passenger lounge side of the inboard bulkhead of each MES Station.

92.14.4 Engine Room No. 1 Welding Station Canopy Hood Lighting

Provide lighting for the welding station in accordance with the requirements of the *Welding Station Vent Canopy Hood* Subsection in Sections 64 and 80 of the Technical Specification.

92.15 NAVIGATION LIGHTS

Provide a Navigation Light and Transfer Panel for each Pilothouse as directed below and to meet all Authoritative Agencies requirements.

For WSF Fleet-wide Standardization purposes provide a HENSCHEL Model 46 Navigation Light Control Panel, in each Pilothouse. Arrange the navigation lights controlled by these panels to be similar to other WSF Vessels.

Provide PERKO 1164 REO PLB and 1164 GEO PLB, or LIGHTPARTNER/P&B TYPE 740, or equal sidelights; PERKO 1165 EEO PLB, or LIGHTPARTNER/P&B TYPE 740, or equal masthead lights; and 1166 EEO PLB, or LIGHTPARTNER/P&B TYPE 740, or equal stern lights. All running lights shall be of dual section construction. Two (2) full sets of running lights shall be provided, each controlled from both of the Pilothouse Navigation Light Control Panels. In addition, provide two (2) anchor lights (PERKO 1169 EEO PLB or LIGHTPARTNER/P&B TYPE 740, or equal), one located on each End of the Vessel and controlled from the No. 1 Pilothouse Navigation Light Control Panel, and a set of "Not Under Command" lights (PERKO 1172 REO PLB or LIGHTPARTNER/P&B TYPE 740, or equal), with dedicated weathertight receptacles and flexible pigtails, to be hoisted on a halyard on the main mast on No. 2 End of the Vessel and controlled from the No. 2 Pilothouse Navigation Light Control Panel.

Provide one (1) anchor light (PERKO 1169 EEO PLB, or LIGHTPARTNER/P&B TYPE 740, or equal), located on No. 2 End of the Vessel. Provide one (1) combination anchor/fueling light (PERKO 1168 HEO PLB, or LIGHTPARTNER/P&B TYPE 740, or equal), with top lens "WHITE" (anchor) and bottom lens "RED" (fueling), located on No. 1 End of the Vessel. All these lights shall be controlled from the No. 1 Pilothouse Navigation Light Control Panel.

The Transfer Light panel shall be configured identical to the WSF Fleet-wide Standard and shall be arranged such that a single switch will change the orientation of the bow from End to End.

All navigation lights, their locations, and control panels shall be in full compliance with all applicable USCG regulations.

92.16 SEARCH LIGHTS

For WSF Fleet-wide Standardization purposes provide four (4) 500W CARLISLE-FINCH X9398-HRF search lights two (2) mounted on each Pilothouse housetop. The search lights shall be provided with distant electric controls from the interior of the Pilothouse. There shall be two (2) joy-stick controllers for each light for a total of four (4) joysticks in each Pilothouse. Locate the joysticks as approved by the WSF Representative.

Power for the search lights shall be provided from the final "EMERGENCY" power panel in the corresponding Pilothouse with the search light power supplies mounted in the corresponding Electrical Distribution Room.

92.17 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools for those items which are Contractor furnished, together with any instruction manuals which may be required, to maintain and service provided equipment and accessories as required by Sections 86 and 100 of the Technical Specification.

92.18 TEST, TRIALS AND INSPECTIONS

Tests and trials shall be in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and in Sections 1 and 2 of the Technical Specification.

92.19 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be submitted during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification.

The ***Lighting Deck Plans,*** required by Section 100, shall consist of overlays of the cable and fixtures on the general arrangement drawings for all decks, flats, and platforms, with detail views added to show typical lighting installations. Material lists shall be appended to the lighting plans that give details of all general and special purpose fixtures.

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

92.20 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following deliverable, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be submitted during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Lighting Calculations

The ***Lighting Calculations*** shall include the type, layout, dimensions of lighting levels in all spaces and areas throughout the Vessel. See **TABLE 92-1** for WSF required lighting levels for specific spaces and areas. See Reference (92C) for additional lighting guidance, and levels for areas which may not be covered in **TABLE 92-1**.

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

(END OF SECTION)